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PUMPING FISH FROM RIVER SEINES WITH THE CHERNIGIN FISH PUMP

/Figure is appended./

In contrast to stationary fish pumps used for unloading fish from ships at fish-processing plants, a portable unit for pumping fish from seines has been developed by Engineer Chernigin. All parts of the fish pump are mounted on a boat.

The centrifugal pump, which feeds water into the mixing chamber, is driven by a 52-horsepower STZ-NATI tractor engine. The engine is directly connected to the pump by means of a flexible coupling. The water-intake pipe, provided with a check valve, comes out over the side of the boat, and is enclosed in a wooden guard. The fish are sucked in through an 8-inch flexible rubber hose, which is raised and lowered by use of a crane and manually operated winch. The main parts of the fish pump are shown in the appended sketch.

Before pumping is begun, the bag of the seine is manually guided underneath the fish-intake hose, so that the snore piece enters the seine 20-30 meters from the water-intake pipe. The bag is straightened out, the slack picked up, and the fish gathered in rather thick masses.

A wooden guard encloses the water-intake pipe, and beyond it is the rubber fish-intake hose. An iron bellmouth, called a fish-intake snore piece, forms the end of the hose. A metal structural frame is fitted to the snore piece to prevent the seine itself from being sucked in.

The ratio of fish to water in the bag of the seine before pumping is begun is approximately 1:2.

After theseine bag has been placed and straightened, the crane and winch are used to lower the fish-intake hose, the snore piece of which dips into the fish. To keep the fish-to-water ratio constant, the fish are continuously concentrated in the bag by taking in the slack.

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When pumping starts, the fish pass through the snore piece, into the mixing chamber, through the vent, through the diffusor, and finally into the fish bin, which has been tied to the pump boat during the time that the seine was placed in position. The diffuser is equipped with a canvas sleeve to control the direction of the discharge of fish and water.

To determine the productivity of the fish pump, a series of experiments were conducted in 1941 in the hatchery of the "Pervomayskaya" Fish-Breeding Combine of the Volga-Caspian Trust. Results of these experiments are shown in Table 1.

Table 1

Experiment No	Total Operation Min	Sec	Pumping Min	Sec	Fish Pumped (Centners)	Productivity (tons/hour) Theoretical	Working
1	27	30	8	00	135	101.00	49.00
2	20	20	9	15	125	87.30	39.80
3	10	28	9	33	130	81.67	74.52
4	13	45	7	45	120	92.90	52.36
5	14	41	4	03	55	81.50	22.47
6	31	22	9	42	50	30.93	19.83
7	28	40	11	30	185	96.52	38.90
8	30	25	16	10	230	85.36	29.62
9	14	40	4	00	55	82.50	17.70
10	19	40	10	55	170	96.38	33.72
11	33	20	15	10	170	67.25	30.60

Under "theoretical productivity" is given the quantity of fish that would be pumped per hour by continuous operation of the fish pump, i.e., without taking into account the time consumed in auxiliary operations (placing and tying the fish bin, raising and lowering the hose, etc.). "Working productivity" denotes the quantity of fish actually pumped per hour, i.e., taking into account both pumping and all auxiliary operation time.

From Table 1 we see that the average theoretical productivity of the fish pump was 82.1 tons per hour, and the average working productivity was 37.1 tons per hour.

For purposes of comparison, 15 observations of manual loading of fish from a seine into two troughs were conducted in the same hatchery. Results of these observations are shown in Table 2.

Table 2.

Observation No	Total Operation Min	Sec	Loading Min	Sec	Fish Loaded (Centners)	Productivity (tons/hour) Theoretical	Working
1	5	40	4	10	10	14.40	10.60
2	10	00	7	56	45	34.03	27.00
3	9	30	7	54	40	30.38	25.26
4	7	25	5	45	25	26.10	20.20
5	5	47	3	32	17	28.87	17.68
6	23	54	17	40	100	34.00	25.10
7	49	15	23	05	90	23.40	10.96
8	10	00	4	45	20	25.26	12.00
9	16	35	7	35	35	27.74	19.61
10	12	10	7	20	40	32.80	19.72

Table 2 (contd)

Observation No	Total Operation Min	Sec	Loading Min	Sec	Fish Loaded (Centners)	Productivity (tons/hour) Theoretical	Working
11	10	15	6	35	30	27.34	17.56
12	17	50	12	20	75	36.50	25.96
13	16	50	10	30	55	31.43	19.60
14	11	55	8	05	45	33.40	22.66
15	8	10	4	25	15	20.38	11.00

The theoretical productivity of manual loading into troughs was 28.3 tons per hour, and the working productivity was 18.5 tons per hour.

In connection with the productivity of the fish pump, the question arises whether fish passing through the apparatus during the pumping operation were injured. Samples were taken both from the fish bin and from the troughs. Examination of the fish from the bin revealed that no injuries such as torn heads, damage to the gills, and wounded bodies were suffered by such species as pike, perch, carp, bream, vobla, and herring. A very small number of fish had light head and gill injuries. The full extent of injury to the fish is not known definitely, but not more than 0.5 percent of the total number of fish pumped were injured. In general, it was possible only to notice injuries to the scales, and injuries of this type were greatest among herring, bream, and vobla. Scale loss among pike, perch, and carp was scarcely noticeable.

Comparative data on the number of injuries to fish pumped through the fish pump and to those unloaded by hand is given in Table 3.

Table 3

Species	Total Fish in Sample	Injured	Uninjured	Fish Injured (in %)
Fish Loaded by Pump				
Bream	41	12	29	39.3 [sic]
Bream and vobla	42	14	28	23.3 [sic]
Others	21	7	14	33.4
Fish Loaded by Hand				
Bream and vobla	56	12	44	21.4
Others	53	11	42	20.8

Scale loss accounted for about 20 percent of the injuries listed in the table. Damage to the scales of fish in the pumping process is perhaps the basic disadvantage of the fish pump, but this disadvantage can be considerably moderated or even eliminated.

One of the basic advantages of this fish pump is its ability to work even when air gets into the fish-intake hose. Since air in the fish-intake hose does not affect operation of the pump, there is no interruption of operations when suction piece is only shallowly submerged. Even under such conditions, the pump is so efficient that almost all fish are pumped from the seine. Only 0.5 - 1 centner remain behind in the seine.

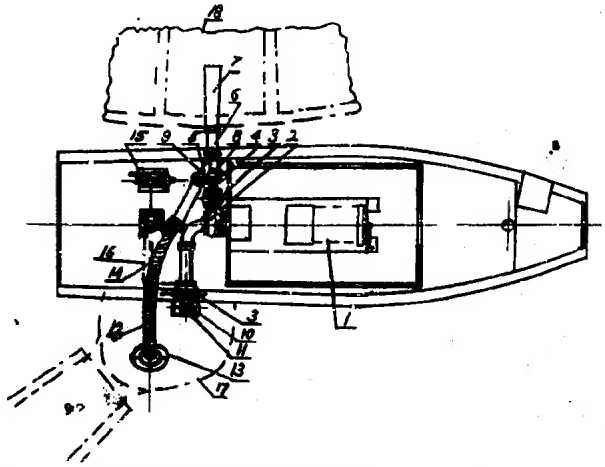
Injuries to the fish being pumped through the fish pump depend to a considerable degree on the speed of the stream of water discharged from the nozzle. This speed was 17 meters per second for the apparatus described. Calculations show that by selection of an appropriate centrifugal pump with proper diameter of the nozzle, the speed of the stream can be cut down and thereby loss of scales reduced. With improvement of the fish pump, it could become more valuable to industry.

Pertinent disadvantages in the design of the apparatus described are the following:

1. The diffusor did not discharge the fish properly due to its shape. The steam coming out from the diffusor splattered. The fish hit against the beams and the edges of the bin. Some fish even flew over the edge and fell back into the river. The canvas sleeve fastened to the end of the diffusor was not fully effective. The shape of the diffusor should be modified to give it an appropriate shape.

2. The water-intake pipe equipped with check valve was placed on the same side of the boat as the bag of seine. Such a placement is unfortunate because in the pumping process the seine tended to be drawn underneath the boat. It seems more logical that the water-intake pipe be situated in the stern of the boat or on the opposite side.

The floating fish pump designed by Engineer Chernigin may not only be used to pump fish from seines used in high-production hatcheries, but also for loading fish caught in other types of nets.



Floating Chernigin Fish Pump

Key

1. STZ-NATI tractor engine
2. 8-inch centrifugal pump
3. Ludlow valve
4. Reducing pipe
5. Mixing chamber
6. Vent
7. Diffusor
8. Vacuum gauge
9. Pressure gauge
10. Water-intake pipe with check valve
11. Wooden guard
12. Fish-intake hose
13. Fish-intake snore piece
14. Crane
15. Winch
16. Protective shed over apparatus
17. Bag of the seine
18. Fish bin

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